change-professors," "Amerika Houses," and the like is familiar. Even more noteworthy this spring was the attention given to the work of American scholars. At least, this was noticeable in the writer's department of philosophy. At Erlangen, Falckenberg had recently granted a doctorate based on the study of Dewey's pragmatism. In Heidelberg, Troeltsch, beginning his course on the philosophy of religion "for members of all faculties," was discussing pragmatism (as well as the work of the English anthropologists). In Jena, Eucken's "Uebungen" were based on Wobbermin's translation of James's "Varieties of Religious Experience." It would be too much to say that this interest in recent phases of our thinking always indicates agreement. One rather gathers the impression from German scholars that the pragmatic philosophy is not gaining, but losing ground. But it was an agreeable reminder that the scholars and the scholarship of the two nations have come into closer touch. Our indebtedness to the German universities is large. And for some time yet we will continue, if we are wise, to increase our obligations, accepting more than we attempt to give in return. But it was not unwelcome to discover that some beginning of repayment had been made.

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SPECIAL ARTICLES

ANOTHER VIEW OF SEX-LIMITED INHERITANCE

AMONG results which were obtained by the writer during several years of work in crossing blond ring-doves (*Turtur risorius*) with white ring-doves (*T. alba*), was sex-limited inheritance. When the male bird is white, *i. e.*, recessive, the offspring in F_1 are about equally white or blond like one parent or the other, and the white birds are *all females*. By the reciprocal cross, all of the F_1 offspring are blonds like the male parent.

The blond and the white ring-doves may be distinguished by a group of characters which behave apparently as a unit, so that a simple formula may be used to represent the situation. The white ring-dove differs from the blond bird as follows: (1) melanin pigment is almost entirely absent in the feathers; (2) there is little of this pigment in the skin; and (3) the eyes contain extremely little melanin pigment except in the iris region. In other words, the dominant characters of the blond bird are represented in the white dove in an extremely dilute or very slightly developed form, but they are not entirely absent. Their appearance suggests strongly the idea that development has been arrested.

The late Professor Whitman obtained white females in F_1, when white male ring-doves were crossed with females of the very different species, *Turtur humilis*. This result is mentioned by Bateson.[1] A similar result has been described by Staples-Browne[2] for a cross between a male white ring-dove and females of another very different species, *Turtur turtur*.

A number of other cases as well as these have the common characteristic that recessive F_1 offspring appear when the male parent is recessive, and these individuals are always females. Dominant characters are borne by the F_1 males and sometimes by F_1 females. Thus, two dominant females were obtained by Durham and Marryat[3] with canaries and two by the writer with ring-doves, in crossing recessive males with dominant females.

Cases of sex-limited inheritance which have occurred in animals, and especially with birds, have been interpreted by Spillman,[4] Bateson[5] and others with the following as-

[1] Bateson, "Mendel's Principles of Heredity," University Press, Cambridge, England, 1909, p. 194.

[2] Staples-Browne, "Second Report on the Inheritance of Color in Pigeons, together with an Account of some Experiments on the Crossing of certain Races of Doves, with special reference to Sex-limited Inheritance," *Jr. Genetics*, 1912, Vol. 2, No. 2, pp. 131–162, plates VI.–IX.

[3] Durham and Marryat, "Note on the Inheritance of Sex in Canaries," Report to the Evolution Committee, Roy. Soc., 1909, IV., pp. 57–60.

[4] Spillman, "Spurious Allelomorphism: Results of Recent Investigations," *Am. Nat.*, Vol. 42, 1909, pp. 610–615.

[5] Bateson, "Mendel's Principles of Heredity," University Press, Cambridge, England, 1909, 396 pages.

sumptions: (1) that the male is homozygous for sex and the female heterozygous; and (2) that a "spurious allelomorphism" may exist with the consequence that certain sex and somatic factors may not be present in the same gamete.

These two assumptions are unnecessary if the cytological evidence that male and female determining sperms are produced by the male is regarded. The eggs may then be considered to be all alike. The appearance of recessive females in F_1 may then be explained with the assumption that the female-determining sperms of the recessive male parent may suppress the development of dominant characters in the resulting zygote, or it may be assumed that these sperms lack something which is necessary to the proper development of the dominant characters even when the female parent bears them. Whether this suppressing power or the lack of something necessary for the development of dominant characters is connected with an accessory chromosome or not, is not essential to the assumption.

In the formulæ which follow, the characters of the blond ring-dove are designated by B and those of the white bird by W. Female-determining sperms are distinguished by a subscript $_f$ with an additional $_w$ in the case of those which are produced by the white (recessive) male. It seems more appropriate, and less confusing, also, to call all sperms male and all eggs female, whether two kinds of either exist or not, instead of using the signs of both sexes, as is done commonly, for the gametes of the sex which is considered to be heterozygous. Characters which are recessive to others, in the same individual, are included in parentheses.

1. Blond ring-dove males × White ring-dove females.

composition: $B♂\,B(♀)$ × $W♀\,W(♂)$

producing gametes: $B♂$, $B_f♂$ × all $W♀$

result: Blonds, mostly males $B♂\,(W♀)$ × Blond females, a few. $B♀\,(W♂)$

2. White ring-dove males × Blond ring-dove females

composition: $W♂\,W(♀)$ × $B♀\,B(♂)$

producing gametes: $W♂$, $W_{fw}♂$ × all $B♀$

result: Blond males $B♂\,(W♀)$ × White females $W_w♀\,B(♂)$ becoming $W♀\,W(♂)$ through presence of condition indicated by subscript $_w$.

Blond females, occasionally, through absence of $_w$ effect.

As the white F_1 hybrids were all females, it was not possible to breed white hybrids *inter se*. When these white hybrids were crossed back on stock white males, only white offspring were obtained, and they were found to be so-called extracted recessives.

3. Blond F_1 hybrid ring-dove males × White ring-dove females.

composition: $B♂\,(W♀)$ × $W♀\,W(♂)$

producing gametes: $B♂$, $B_f♂$, $W♂$, $W_{fw}♂$ × all $W♀$

result: Blond males $B♂\,(W♀)$ × Blond females $B♀\,(W♂)$

White males $W♂\,W(♀)$ × White females $W♀\,W(♂)$

4. Blond F_1 ring-dove hybrid males × Blond ring-dove females.

composition: $B♂\,(W♀)$ × $B♀\,B(♂)$

producing gametes: $B♂$, $B_f♂$, $W♂$, $W_{fw}♂$ × all $B♀$

result: Blond males $B♂\,B(♀)$ and also $B♂\,(W♀)$ × Blond females $B♀\,B(♂)$

White females $B♀\,W_{fw}(♂)$ becoming $W♀\,W(♂)$ through presence of condition indicated by subscript $_w$.

Only two successful matings of blond hybrid F_1 ring-doves *inter se* were made, as blond hybrid females were seldom obtained. The expectation for such a cross is given in the following formula. Males and females of both colors were obtained, but their composition was not tested.

5. Blond F_1 hybrid males	×	Blond F_1 hybrid females.
composition		
$B♂$ ($W♀$)		$B♀$ ($W♂$)
producing gametes	$B♂$	
	$B_{fw}♂$	$B♀$
	$W♂$	$W♀$
	$W_{fw}♂$	
result: Blond males		Blond females
$B♂B(♀)$		$B♀B(♂)$
and also		and also
$B♂$ ($W♀$)		$B♀$ ($W♂$)
White males		White females
$W♂W(♀)$		$W♀W(♂)$ and also $B♀W_w(♂)$ or $W♀W(♂)$

A more detailed description of the results which were obtained by the writer in crossing ring-doves has been prepared for publication, and a preliminary statement[6] has appeared in this journal.

The interesting results, recently described by Cole,[7] are easily explained by this scheme when we recognize that yellow, dun, red, etc., in pigeons are due essentially to less intense melanin pigmentations than that which is represented in black. The dun females in both of Cole's "Cases I. and II.," would then be due to conditions in the female-determining sperms of the recessive male (designated by subscript $_{fw}$ in the formula used in this article). The occurrence of red, yellow and dun in the offspring from the reciprocal cross is not surprising when the uncertain purity of domestic-pigeon stock is considered. Durham and Marryat compared their canaries on the basis of eye-color, as the numerous color variations of the plumage were less satisfactory characters.

R. M. STRONG

[6] SCIENCE, N. S., Vol. 33, p. 266, 1911.
[7] SCIENCE, N. S., Vol. 37, pp. 190–192.

FURTHER NOTE ON THE RESULTS OF OVARIOTOMY ON DUCKS

ON July 26 of the present year, one of the ducks (No. 24, now three years old) on which ovariotomy had been performed as recounted in the *Biological Bulletin*, Vol. XX., No. 1, 1910, was killed and dissected. In my original report I stated simply that the bird was castrated, but made no statement concerning the completeness of the ovaries' removal. It is the purpose of this note to supply this lack. But before proceeding to describe the results of the autopsy, certain points should be briefly reviewed.

August 13, 1909, the *left* ovary was removed, no attempt being made to remove the right gonad, which it was assumed had completely degenerated. The duck was then 12 weeks old and already had the secondary sexual characters of the female which are distinct from those of the young male. For nearly a year afterwards this bird passed as an ordinary female. Then it was observed that a part of her feathers were like those of a male. At a moult soon after, she assumed still more of the male's characters, being in the condition shown in Fig. 11 of my earlier report. Subsequently, still more of the male's characters were acquired until her plumage was predominately, yet incompletely, male. For the last 18 months or so the plumage has remained in this intermediate condition, though several moults have occurred in the meantime.

At the autopsy no trace of an ovary on either side could be found. The only duct present was a well-developed but juvenile oviduct on the left side.

The other duck (No. 4), described in the paper referred to above, was examined through an opening in the left side on August 22. The site of the ovary was empty except for a thin strand of connective tissue. As far as could be seen from the left, the right side also was completely empty. This duck, operated on when nearly a year old, had laid several eggs in the period immediately preceding the operation. One was removed from the oviduct at the operation. She has developed only